

The Relationship Between Dental Caries, Food Intake and Body Composition in School-Age Children

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Abstract

Purpose: The aim of this study is to evaluate the relationship between dental caries, food intake and body composition in school-age children.

Methods: The study was conducted on 210 children, 105 boys and 105 girls, aged 6-12 years, without mental and / or physical disorders. Oral examinations of the children were performed by pediatric dentists and DMFT –DMFS and dmft-dmfs values were recorded. A detailed food frequency questionnaire was applied to determine consumption frequency of dairy products and sugar-added foods. Children's height, waist and hip circumference measurements were taken by the researcher; body weight and body composition were evaluated with Tanita BC-601F body analyzer.

Results: DMFT values were found to be lower in children who consumed milk, buttermilk and white cheese daily, but this differences were not statistically significant ($p>0.05$).

Body weight and waist circumference are found to be positively correlated with DMFT and negatively correlated with dmft. BMI was found to be positively correlated with DMFT; negatively correlated with dmft ($p<0.05$).

Conclusions: In this study, dental caries was found to be associated with food consumption and body mass index. In children, consumption of sugary foods should be reduced and consumption of milk and dairy products should be increased.

1. Introduction

In the transition from childhood to adolescence, the school age period is a critical life phase in which nutritional and oral health habits develop (1). Dental caries are a common chronic disease in school-age children, although it is now known that it is almost completely preventable. Dental caries are frequently seen due to the changing lifestyle and the increase in the consumption amount and frequency of sugar and sugary foods (2).

While studies indicate that the prevalence of caries in children has decreased in many developed countries, dental caries is still an important public health problem developing countries (3, 4). Globally, the World Health Organization (WHO) reports that the prevalence of dental caries in school-age children in most countries is between 60–90% (5).

The main factors controlling the risk of dental caries in school-age children are dietary habits, oral hygiene and fluoride exposure (6). The frequency and amount of consumption of simple sugars are associated with dental caries. According to epidemiological, animal and human intervention studies, both frequency and amount of sugar consumption are important in caries etiology. Frequency of added sugar consumption is a more dominant factor in the etiology of dental caries, but there are evidence that the amount of sugar consumption affects the development of dental caries regardless of frequency (2, 7, 8).

The prevalence of obesity in childhood has increased due to changes in diet and lifestyle. Childhood obesity is likely to continue in adulthood and it causes many problems, including the increased risk of developing chronic diseases. Many studies in the literature have associated dental caries with childhood obesity (6–10). Since childhood obesity is generally evaluated with body mass index, BMI is generally used to evaluate between dental caries and childhood obesity. Also anthropometric measurements are used to assess this relationship in children (10).

There is limited number of studies evaluating the relationship between dental caries, food consumption and body composition in school-age children. This study was conducted to evaluate the relationship between dental caries, food consumption and body composition in 6–12 years old children.

2. Methods

2.1. Study Design and Population

A total of 210 children aged 6–12 years, 105 boys and 105 girls without mental and / or physical disorders who applied to Hacettepe University Faculty of Dentistry Department of Pedodontics with dental problems were included in this study. This study was conducted as a master's thesis and was approved by the Ethics Committee of Ankara University. Before the questionnaire was applied, all children and their families were informed about the content of the study. Parents gave written consent and children gave verbal consent.

Assessment of Children's Dental Health

In order to evaluate the oral health practices of children, using of toothbrushes, frequency of tooth brushing, using of fluoride toothpaste and the frequency of dentist visiting were questioned with questionnaire form. Dental examinations of the children were conducted in Hacettepe University, Faculty of Dentistry, Department of Pediatric Dentistry. Dental examinations were performed by two pediatric dentists under reflector light with a mirror and a probe. Dental caries of the primary and permanent teeth were measured by the total number of decayed, missing, filled teeth (DMFT and dmft) according to the guidelines of the WHO. Also decayed, missing, filled tooth surfaces (DMFS and dmfs) were measured for each child (11).

Assessment of Food Consumption

Dietary intake was obtained by a 24-hour dietary recall method from mother. Dietary intake was completed by asking the child himself / herself when it is necessary. A detailed food frequency questionnaire was applied to determine consumption frequency of dairy products and sugar-added foods (biscuits, spreadable chocolate, sweets etc.). Frequency was categorized as 1–2 times a day, 4–5 times a week, 3 times a week, 1–2 times a week, 1–2 times a month and never.

Measurements

Body height was measured to the nearest 0.1 cm with a stadiometer. Body weight and body fat (%) were measured with the Tanita BC-601F body analyzer when they hungry in the morning. BMI (kg/m²) values was calculated according to the formula [body weight (kg) / height² (m²)]. Waist and hip circumferences was measured to nearest 0.1 cm with a tape measure. BMI classification in children was made according to WHO (2007) reference values. Children was divided into four groups according to the BMI for age percentile: underweight - less than the 5th percentile; healthy weight - 5th percentile up to the 85th percentile; overweight - 85th to less than the 95th percentile; and obese - equal to or greater than the 95th percentile (12).

Statistical Analysis

The statistical analysis of the data was performed using SPSS 22 program. Whether the quantitative data has a normal distribution or not was evaluated with the "Kolmogrov-Smirnov" test. Descriptive statistics were expressed with mean \pm standard deviation ($\bar{X} \pm SD$) for normally distributed variables, median and lower-upper values for variables with non-normal distribution, and number (n) and percentage (%) for nominal variables. Chi-square test were used to compare categorical datas. For examining the correlations between two quantitative variables, Pearson Correlation Coefficient was used when at least one of the variables showed normal distribution, and Spearman Correlation Coefficient was used when did not.

3. Results

Oral health behaviours of children by gender are given in Table 1. Of all the children, 41.9% brushed their teeth once a day, 31.0% brushed twice a day, 25.7% brushed irregularly. But there was no statistically significant difference between tooth brushing frequency groups ($p=0.177$, $p>0.05$). The vast majority of children (86.1%) reported that they visit the dentist when they have dental complaints. There was statistically significant difference between dentist visiting frequency groups ($p<0.05$).

Table 1

Oral Health Behaviours of Children by Gender

Oral Health Behaviours	Male (n=105)		Female (n=105)		Total (n=210)		p
	n	%	n	%	n	%	
Tooth Brushing Frequency							
Once a day	50	47,6	42	40,0	88	43,8	0,177 ^a
Twice a day	25	23,8	37	35,2	65	29,5	
Irregular	30	28,6	26	24,8	54	26,7	
Using Fluoride Toothpaste							
Using	74	70,5	78	74,3	152	72,4	0,608 ^a
Not using	20	19,0	20	19,0	40	19,0	
Unknowing	11	10,5	7	6,7	18	8,6	
Frequency of Dentist Visiting							
Once in a year	7	6,7	1	1,0	8	3,9	0,005 ^{b*}
Twice in a year	5	4,7	16	15,2	21	10,0	
When they have a complaint	93	88,6	88	83,8	181	86,1	

^aPearson Chi-square Test; ^bFisher's Exact Test; *p<0,05

Averages of children's dental health indicators by gender are given in Table 2. For all the children, the mean DMFT and DMFS values were 2.02 ± 1.89 and 3.57 ± 3.12 , respectively. There are no statistically significant differences between genders for the mixed dentition, permanent dentition and total ($p>0.05$).

Table 2

Dental health indicators of children by gender and type of dentition

	Male	Female		
	Mean±SD	Mean±SD	t	p
Mixed Dentition (n=179)				
DMFT	1.68±1.72	1.75±1.72	0.283	0.778
DMFS	2.60±3.32	2.68±3.34	0.162	0.871
dmft	6.17±3.22	6.41±3.52	0.623	0.534
dmfs	17.04±11.53	17.47±13.10	0.233	0.816
Permanent Dentition (n=31)				
DMFT	3.95±2.03	3.45±1.96	0.655	0.517
DMFS	6.05±4.17	4.90±2.87	0.805	0.428
Total (n=210)				
DMFT	2.08±1.98	1.90±1.80	0.688	0.492
DMFS	3.32±3.79	2.93±3.35	0.700	0.485

SD: Standard deviation; t: Independent Samples T Test

The average of dental health indicators by the daily consumption of milk and dairy products is given in Table 3. DMFT values were found to be lower in children who consumed milk, buttermilk and white cheese daily, but this differences were not statistically significant ($p>0.05$).

Table 3

Dental Health Indicators of Children According to the Daily Consumption of Dairy Products

Daily consumption	DMFT	Number of decayed teeth	Daily consumption	dmft	Number of decayed teeth
	Mean±SD	Mean±SD		Mean±SD	Mean±SD
Milk			Milk		
Consuming (n:90)	1.81±1.71	0.94±1.20	Consuming (n:80)	6.15±3.35	2.36±2.25
Not consuming (n:120)	2.15±2.01	1.07±1.56	Not consuming (n:99)	6.48±3.40	2.85±2.32
p	0.268	0.510	p	0.562	0.159
Yogurt			Yogurt		
Consuming (n:61)	2.19±1.96	0.96±1.35	Consuming (n:52)	6.27±3.74	2.05±1.94
Not consuming (n:149)	1.95±1.87	1.04±1.44	Not consuming (n:127)	6.35±3.22	2.79±2.39
p	0.280	0.735	p	0.892	0.050
Buttermilk			Buttermilk		
Consuming (n:32)	1.78±1.64	0.78±1.21	Consuming (n:29)	5.75±3.39	2.56±1.87
Not consuming (n:178)	2.06±1.94	1.06±1.45	Not consuming (n:150)	6.38±3.52	2.68±2.37
p	0.435	0.304	p	0.365	0.781
White cheese			White cheese		
Consuming (n:98)	1.90±1.79	0.81±1.31	Consuming (n:85)	6.25±3.41	2.55±2.49
Not consuming (n:112)	2.12±1.99	1.19±1.48	Not consuming (n:94)	6.31±3.42	2.60±2.10
p	0.408	0.049*	p	0.903	0.877

*Independent Samples T Test; *p<0,05; SD: Standard deviation*

The average of dental health indicators by daily consumption of sugar and sugary foods are given in Table 4. The DMFT index (3.08 ± 2.10) was found to be higher in children who consumed the biscuit daily compared to children who did not (1.95 ± 1.87) ($p<0.05$). The DMFT values of children who consumed spreadable chocolate daily and not were found to be 3.09 ± 1.84 and 1.90 ± 1.87 , respectively. It was found that this difference was statistically significant ($p<0.05$).

Table 4

Dental Health Indicators of Children According to the Daily Consumption of Sugar and Sugar-Added Foods

Daily consumption	DMFT	Number of decayed teeth	Daily consumption	dmft	Number of decayed teeth
	Mean±SD	Mean±SD		Mean±SD	Mean±SD
Added sugar			Added sugar		
Consuming (n:62)	2.24±1.91	1.20±1.52	Consuming (n:52)	6.30±3.43	2.60±2.33
Not consuming (n:148)	1.93±1.89	0.93±1.36	Not consuming (n:127)	6.23±3.37	2.51±2.20
p	0.283	0.208	p	0.892	0.818
Sweets			Sweets		
Consuming (n:5)	3.60±2.30	2.40±1.14	Consuming (n:5)	5.20±4.43	1.80±0.83
Not consuming (n:205)	1.98±1.88	0.98±1.40	Not consuming (n:174)	6.31±3.38	2.60±2.31
p	0.061	0.027*	p	0.472	0.441
Biscuits			Biscuits		
Consuming (n:12)	3.08±2.10	1.83±2.08	Consuming (n:9)	8.44±2.92	3.22±2.63
Not consuming (n:198)	1.95±1.87	0.96±1.35	Not consuming (n:170)	6.17±3.40	2.54±2.27
p	0.004*	0.052	p	0.051	0.391
Spreadable chocolate			Spreadable chocolate		
Consuming (n:21)	3.09±1.84	1.53±1.52	Consuming (n:19)	5.26±2.92	1.94±1.50
Not consuming (n:189)	1.90±1.87	0.96±1.39	Not consuming (n:160)	6.40±3.45	2.65±2.36
p	0.006*	0.085	p	0.168	0.203

*Independent Samples T Test; *p<0,05; SD: Standard deviation*

The correlations between body composition measurements and dental health indicators are shown in Table 5. Height, body weight and waist circumference are found to be positively correlated with DMFT and negatively correlated with dmft. Waist / hip ratio was found to be positively correlated with only

DMFS ($p < 0.05$). BMI was found to be positively correlated with DMFT; negatively correlated with dmft ($p < 0.05$).

Table 5

Correlations Between Body Composition Measurements and Dental Health Indicators

	DMFT		DMFS		dmft		dmfs	
	r	p	r	p	r	p	r	p
Height (cm)	0.466	0.000**	0.382	0.000**	-0.402	0.000**	-0.187	0.012*
Body weight (kg)	0.409	0.000**	0.315	0.000**	0.345	0.000**	-0.149	0.043*
Waist circumference (cm)	0.242	0.001**	0.189	0.009**	-0.212	0.013*	-0.117	0.175
Waist to hip ratio	0.118	0.259	0.185	0.038*	-0.031	0.724	-0.017	0.821
Body fat (%)	0.089	0.119	0.034	0.327	-0.085	0.320	-0.104	0.153
BMI (kg/m ²)	0.223	0.002**	0.156	0.041*	-0.182	0.049*	-0.125	0.317

* $p < 0.05$, ** $p < 0.01$

4. Discussion

In this cross-sectional study, we aimed to examine the effects of dietary habits and body composition on dental caries.

Poor oral hygiene is defined as the onset of dental caries. Children in the 6–12 age group with mixed and permanent dentition were included in this study. Those who brush their teeth more than once a day until the age of 12 are more likely to continue this habit in adolescence and adulthood (13). In this study, even half of the children do not brush their teeth once a day.

DMFT and dmft indexes are used in studies to determine oral health in our country and world. In the present study, the mean DMFT value of the children was found as 2.02 ± 1.89 . In studies conducted in different regions of our country, different DMFT and dmft values were obtained (14–18). In a study conducted with a total of 4657 people across Turkey, the average DMFT index for children aged 12 was determined to be 1.9 ± 2.2 (14).

In this study, the DMFT value was found to be lower in children who consumed milk daily than those who did not but the difference was not statistically significant. In many studies, it has been shown that dairy

consumption has an effect on the reduction of dmft index in primary dentition and DMFT index in permanent dentition in children (19–22). Yang et al. found that daily milk consumption is associated with less caries risk in permanent teeth in school children (22). Kesim et al. also reported milk consumption was found to be significantly associated with DMFT values (23).

In this study, DMFT value was higher in children who consumed biscuits and spreadable chocolate daily than who did not ($p < 0.05$). In the literature, it has been reported that overweight and obese children prefer sugary and fatty snacks more frequently than children with normal weight. Sugary food consumption increases not only the risk of obesity but also increases the risk of dental caries (24–26). Similarly to our study, in a study conducted in Spain found that the frequency of biscuit consumption in school-age children was associated with the prevalence of caries (26).

In the present study, a positive correlation was observed between BMI of children and DMFT-DMFS indexes ($p < 0.05$). This result is consistent with many cross-sectional studies that showing a positive correlation between dental caries and childhood obesity in the permanent dentition (9, 10, 24, 25, 27). However, some studies show that dental caries were more common in underweight children (9, 28, 29). In addition, one study reported that dental caries is associated with both high and low BMI (24).

There is a growing body of scientific literature about the relationship between body fat ratio and dental caries. However, the number of studies examining this relationship is not sufficient, and there are conflicting opinions on this issue (30, 31). In this study, a positive correlation was observed between body fat ratio and permanent teeth indicators; a negative relationship was observed between body fat ratio and deciduous teeth indicators but this correlations are not statistically significant ($p > 0.05$).

5. Conclusion

In conclusion, dental caries was found to be associated with both food consumption and body composition in Turkish school-age children. Also this study demonstrates a direct relationship between dental caries and childhood obesity, as evident from a correlation between dental health indicators and BMI. In children, consumption of sugary foods should be reduced and consumption of milk and dairy products should be increased. Further studies with a multidisciplinary diagnostic approach (nutritionists and paediatric dentists) are needed to examine the relationship between childhood obesity and dental caries in depth.

Declarations

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Competing Interests:

The authors have no relevant financial or non-financial interests to disclose.

Author Contributions:

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by İrem Çağla Özel and Gizem Erbaş Ünverdi. The first draft of the manuscript was written by İrem Çağla Özel and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethics approval:

This study was conducted as a master's thesis and approval was granted by the Ethics Committee of Ankara University B (Date: 02.25.2019/ No: 56786525-050.04.04/1446).

Consent to participate:

Written informed consent was obtained from the parents.

Consent to publish:

The authors affirm that human research participants provided informed consent.

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